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P L A N

OF A

COURSE OF LECTURES

ON

ARTS AND MANUFACTURES,

MORE PARTICULARLY SUCH AS RELATE TO

C H E M I S T R Y.

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M D C C X C V I.



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P A R T I.

METALS AND MINERALS.

1. **M**INING in general.
 2. The structure of the earth.
 3. Strata.
 - Hading.
 - Underlie.
 - Dislocation of the strata.
 - Disappearance of the upper strata.
 4. Veins.
 - Strings.
 5. Sinking shafts.
 6. Driving levels.
 - Levelling.
 - Dialling.
 7. Airing
- A

7. Airing mines.

By bellows,

By fire,

By water,

By a horse-head,

8. Draining mines.

By foughs,

By water wheels,

By steam engines.

9. *Iron.*

10. Manner in which the ore is found.

Near the surface of the earth.

In bell-pits.

In mines.

11. Appearances of the ore.

12. Smelting iron.

13. Structure of the furnace.

14. Urging the fire by a combination of forcing cylinders.

15. The blast regulated by a weight,

Or by water.

16. The

16. The flux used.

17. The scoriæ.

18. Tapping the furnace.

19. The metal run into pigs.

Into various forms.

The model.

The flask.

The mold.

20. Cannon cast,

Centered,

Bored,

And turned.

21. Shells cast.

22. Casting large cylinders.

23. The model made by a sweep.

24. The cylinder bored.

25. Casting from a wind-furnace.

The crane.

26. Cast iron rendered malleable.

Puddling.

Shingling and stamping

The forge hammer.

Rolling.

27. Malleable iron manufactured.

28. Bars rolled,

And slit.

29. The making nails.

30. Wire drawn.

Various wire-drawing machines.

31. Cleaning wire,

By friction,

By acids.

32. Iron converted into steel.

The converting furnace.

33. Blistered steel.

34. Proposed method of making steel immediately from the ore.

35. Cast steel.

The casting furnace.

36. The tilting mill.

37. Grinding and polishing steel.

Emery.

Crocus martis.

38. Cut steel.

39. Case-hardening.

40. Tempering steel.

Edge tools.

The cold chisel.

Patent scythe.

Files.

Steel mandrels.

41. The re-conversion of steel into iron by cementation.

42. Modern discoveries in chemistry relative to steel and iron.

43. *Lead.*

44. Manner in which the ore is found.

Pipe veins.

Rake veins.

Slikenfide.

45. Mines in Derbyshire,

Alston Moor,

Durham, &c.

46. Appearance of the ore.
Bing.
Peasey.
Smitham.
Belland.
47. Treatment of the ore.
Buddling.
48. Smelting lead.
49. Smelting furnace or cupola.
Horizontal chimneys.
Slaghearth.
50. Casting or sheeting.
51. Leaden pipes.
52. Rolling lead.
Mill for that purpose.
53. Glazier's vice.
54. Shot.
55. Combination of lead with oxygen.
Litharge.
Red lead.
56. The furnace.
57. Methods

57. Methods of sifting and grinding.
58. Combination of lead with the acetous acid,
White lead.
59. Patent yellow.
60. *Tin.*
61. Mines in Cornwall.
The Wherry mine.
62. The shelf.
63. Ores of tin.
Stream tin.
64. Method of extracting the metal.
65. Grain tin.
66. Tin foil.
67. Block tin.
68. Sheet tin.
69. Tinning of copper vessels.
70. *Copper.*
71. Various mines in Anglesea,
Ecton,
&c.
72. Copper ores.
73. Copper

73. Copper mud.
74. The metal extracted,
And purified.
75. Copper rolled into plates.
Coppering the bottoms of ships.
76. Copper drawn into bolts,
And nails for shipping.
77. The art of engraving copper-plates.
Gravers and other instruments employed.
78. Mezzotinto.
Forming the ground.
Scraping.
79. Etching.
The varnish.
Biting with aqua fortis.
Stopping out.
Producing a variety of shade.
80. Aquatinta.
Etched outline.
Method of laying the ground.

The operation continued by stopping out the lights,

Or by stopping out the shades.

81. Etching in soft ground.
82. Stippling.
83. The dry needle.
84. Proofs.
85. The rolling prefs.
86. Modelling.
87. *Silver.*
88. Separation of silver from lead.
89. Silver and copper sweated together.
90. The art of plating.
91. Stamping machine.
92. *Gold.*
 - Refining.
 - Alloying.
 - Coining.
 - Milling.
93. Gold beaten into leaves.
94. Gilding.
95. *Mixed*

95. *Mixed Metals.*
96. The specific gravity,
Hardness,
And fusibility of the mixtures.
97. Art of foldering.
98. Pewter.
99. Printer's types.
100. Cock metal.
101. Bell metal.
102. Specula.
103. *Brass.*
104. Copper stratified with the ores of zinc.
Calamine.
Blende or black jack.
105. Cast brass.
Hardened by hammering.
Annealed.
106. Brass manufactured into various articles.
Battering Mills.
107. *Coal.*
108. Boring for coal.

The sweep or break.

Boring rods or bits.

The fludging bit.

Keys.

109. Examination of the strata.

110. The strata thrown up or down.

Dykes.

The dip.

111. Coal mines.

Methods of supporting the roof.

Shafts.

Levels.

Canals.

Working the forefield.

112. The nature of choke damp,

And fire damp.

113. Steel mills for giving light.

114. The coal gin.

115. The steam wimsey,

Water wimsey,

And other machines for raising coal.

116. Corfs.
117. Coal waggons.
118. Waggon ways.
119. Contrivances for loading vessels with coal.
120. Works at Whitehaven,
Newcastle,
Worsley,
Coalbrook Dale,
In Staffordshire, &c.
121. Bitumen.
122. Mineral tar.
123. Lord Dundonald's tar works.
124. *Marble.*
125. The different strata.
126. Works at Ashford in Derbyshire.
127. Mills for sawing,
Sweeping,
And polishing marble.
128. Stone quarries.
Methods of working them.
129. Machines used in Masonry.

130. Architecture.

131. Slate quarries.

Slitting the flate.

132. The nature of *Calcareous Stones*.

133. Burning lime.

134. The making mortar.

135. Tarras or puzzolana.

136. Water lime.

137. Alabafter.

138. Plaister of Paris.

139. Stucco. +

140. Clay. *of - the - ... - 7000*

141. Stourbridge and other clays.

Pipe clay. - *in Cornwall - 1500*

142. Clay mixed with flints.

Chirt. *the ...*

Kaolin and petunce. *flint*

143. *Flints,*

Burned, *at ...*

Stamped,

And ground.

144. Pottery.

144. Pottery.

Preparation of the materials.

145. Potter's wheel.

146. Potter's lathe.

147. Molding and modelling.

148. The squeezing box.

149. Burning in the kiln.

150. Painting,

Printing,

And glazing porcelain.

151. The use of flints in the manufacture of
glafs.

The frit.

Green glafs.

Crown glafs.

Flint glafs.

152. Structure of the pots,

And of the furnace for making glafs.

153. Glafs blown,

And formed.

154. Of annealing glafs.

155. The

155. The manufacture of plate glass.

The plates silvered.

156. Cut glass.

157. Glass made for optical purposes.

158. Grinding optical glasses.

The mill for d°.

159. Centering optical glasses.

160. Of painting and staining glass.

161. *Of Saline Minerals.*

162. Pyrites.

Method of extracting green vitriol from them.

163. Common salt.

164. Mineral salt.

The works at Northwich in Cheshire.

Blasting the salt rock.

Upper and lower strata.

165. Brine springs.

166. Sea salt.

Works at Lymington.

Brine obtained by evaporation.

- The brine boiled.
167. Different kinds of salt,
Fishery,
Store-house,
Middle grain,
And sugar-loaf salts.
168. The bittern or mother water.
169. Extraction of glauber,
And Epsom salts from the bittern.
170. Magnesia.
171. Nitre,
Procured from the East Indies.
Obtained from decayed buildings.
172. Modern discoveries relative to its formation.
173. Purification of nitre.
174. Gunpowder.
175. The mill for mixing the ingredients.
176. The corning mill.
177. The glazing tackle or shamping mill.
178. On the strength of various kinds of gun-
powder.

The eprouvette.

179. Gunnery.

180. Sulphur.

Whence obtained.

181. The sulphuric or vitriolic acid.

Method of obtaining it by the combustion
of sulphur.

182. Concentration of the acid.

183. Acids from nitre and sea salt.

184. The manufacture of alum.

185. The preparation of alkaline salts.



P A R T II.



ANIMAL AND VEGETABLE SUBSTANCES,

186. **T**HEIR culture and growth.

187. *Agriculture.*

188. On draining land.

189. Marles and manures.

190. The breed of cattle.

191. The growth of corn.

192. Planting and rearing timber.

193. Felling timber.

194. Making charcoal.

195. The timber sawed into planks.

Saw mills.

196. Wood wrought into various articles.

197. The

197. The growth of feeds,
Rape feed, &c.
198. *Oil* procured from feeds by expression.
The oil mill.
199. Oils hot or cold drawn.
Purification of oil.
200. Oil from animal substances.
201. The nature of fat,
And tallow.
202. Soap hard and soft.
203. Mold and dip candles.
204. The manufacture of wax candles.
Bleaching of wax.
205. Of spermaceti.
The spermaceti whale.
206. Train oil.
207. The whale *fishery* in the North Seas.
Southern fishery.
Harpooning.
The blubber.
The bone.

208. The cod fishery.

Newfoundland Bank.

Curing the fish.

209. The herring fishery.

210. Salmon fishery.

Coops.

Salmon leap.

Raise nets, &c.

211. *Leather.*

Liming,

Curing,

And tanning leather.

212. The use of bark.

213. Modern improvements in tanning.

214. *Saccharine juices* expressed from vegetables.

215. Manufacture of Muscovado sugars in the
West Indies.

216. Refining sugar.

Molasses.

217. Rum.

218. Other saccharine juices fermented.

219. Distilleries.

220. *Arts relative to clothing.*

221. Flax and hemp.

Methods of preparing,

And dressing them.

Heckling.

222. *Cotton.*

Its various kinds from the East Indies.

Isle de Bourbon.

From Panambaca,

Demerary,

And the West Indies.

223. Yellow and white cotton.

224. Beating cotton on a flake.

225. Carding, by hand,

By the carding mill.

226. The drawing or roving mill.

227. Spinning,

By the distaff,

By various hand-wheels,

By machinery.

228. Sir Richard Arkwright's machine.
The mule.
229. Fabric of calicoes,
Muslins,
Fustians,
Velvets.
230. Cutting, burning and brushing.
231. *Silk*.
232. Treatment of filk worms.
233. Winding filk from the cocons.
Raw filk.
White and yellow.
234. Throwing and twisting filk.
235. Fabrics of filk.
236. Crape.
237. *Wool*.
238. Different breeds of sheep.
239. Shearing.
240. Sorting wool.
241. Long wool.

Scouring,

Combing,

Spinning,

Twisting,

And weaving long wool.

242. Stuffs, shalloons, tammies, &c.

243. Pressing and cylindering.

244. Worsted,

The manufacture of hosiery.

245. Short wool,

Swinging wool.

Willies.

246. Scribbling and carding.

247. Slobing and spinning.

248. Warping.

249. Weaving.

Carpet-weaving.

Fancy-work.

250. Dressing cloth.

Tentering.

Milling or fulling.

Cropping.

Pressing.

Frizing.

251. Felting wood.

Rabbit's wool.

Beaver.

Bowing.

Hardening.

Planking.

252. Hats.

253. Woolens whitened by the fume of sulphur.

254. Linen and cotton goods bleached.

255. Modern improvements in the art.

256. *Printing* linens and cottons.

Cutting the prints and blocks.

The pitch points and holes.

257. Preparation of the colours.

Substantive colours.

Adjective colours.

Mordants.

258. Variety of colours struck by the same dye.

259. *Dying*.

259. *Dying*,
Silk,
Wool.
260. Scarlet dye,
Blue,
And other colours.
261. Chipping and rasping woods for dying.
262. The manufacture of *Paper*,
Rags,
Old ropes, &c.
263. Cutting.
264. Washing.
265. The mill for grinding.
266. The use of smalts.
267. Molding.
268. Pressing.
269. Sizing.
270. The glazing and rolling mill.

P A R T III.



ON THE CONSTRUCTION OF MACHINES.

271. **E**NGINES moved by animal strength,
By wind,
By water,
By steam.
272. Methods of applying the strength of animals to the greatest advantage.
273. The different forms of windmills.
The horizontal mill.
The vertical mill.
274. Experiments to determine the force of the wind.
Anemometers.

275. The

275. The best position of the sail.

276. Various water-wheels.

277. Overshot or bucket-wheel.

Experiments to determine its greatest effect.

278. Float-wheel.

The greatest effect of it.

279. Breast-wheel.

280. Observations on the estimate of the force.

281. Its variation as the velocity or square of the velocity.

Newtonian opinion.

Contrary opinions.

282. The force measured by the effect produced.

Various results.

283. On the nature of steam.

284. Its application as a moving force.

285. The principle of the common steam engine.

Bolton and Watts',

Heslop's,

&c.

286. Construction of particular parts of mills and steam engines.
287. Methods of turning the sails of a mill to the wind.
288. Stopping the wind mill.
The break.
289. Regulators.
290. Modes of regulating the supply of water to the wheel.
291. The boiler of the steam engine supplied.
292. The force of the steam regulated.
Gages.
The choke valve.
The safety valve.
293. The jet.
294. Regulation of the steam and jet valves.
295. The condensing cylinder and air-pump.
296. The connexion of the piston-rod and the beam.
297. Circular motion produced,
By a crank,
Or by sun and planet wheel.

298. The use of fly-wheels.

299. Of cog-wheels.

Face or spur-wheels.

Bevil,

And crown-wheels.

Nuts or pinions.

Trundles or wallers.

300. The action of cogs on one another.

301. The shape of the cog.

302. The proportion of the size of the cog to
that of the wheel.

303. Of striking in and out of geer.

304. Friction.

Variation of d° .

Effect of velocity on it.

305. Methods of diminishing friction.

Gudgeons and brasses.

Friction wheels.

Patent rollers.

306. The conversion of linear into circular
motion,

And vice versâ,

By cranks,

Screws,

Racks,

And cams.

307. On the conversion of quick motions into very slow ones.

By a single cog,

By the worm screw,

By ratchet wheels.

308. On the construction of wooden wheels,

309. Cast iron wheels.

310. Brass wheels.

311. Machines for the formation of small wheels.

312. Lathes,

Turned by hand,

By foot-wheels,

By the bow or spring,

By water or steam engines.

313. The different parts,

The bar,

The heads,

The mandrell,

The rest,

The dividing plate.

314. Manner of cutting teeth in wheels.

315. Screws cut,

Upon the lathe,

By stocks and dies,

By screw plates.

316. Of presses,

The screw,

Rolling,

And Printing prefs.

317. Of cranes.

The walk-wheel.

The jigger.

Triangle.

Shears.

318. Lifting jacks.

319. Other machines.

320. On the application of models to large works.

321. The

321. The danger of error in estimating the
moving force,

The effect produced,

Friction and tenacity,

The strength of the machine.



P A R T IV.

WATER-WORKS AND NAVIGATION.

322. A QUEDUCTS.

The supply of water.

Methods of regulating it.

The balance engine.

Gages.

323. Water-works.

324. Forcing pumps.

The air vessel.

Reservoir.

Pipes.

The ball-cock.

325. Canals.

Machines used in cutting canals.

Puddling.

E

326. Tun-

326. Tunnels.
327. Aqueduct bridges.
328. The supply of water.
Reservoir.
Waste water.
329. Locks,
Their general principle,
And construction.
330. Vessels conveyed from one level to another,
Upon inclined planes,
By steam engines,
By counterpoises.
331. The caisson.
332. The vessels used in navigating canals.
333. Canal and river navigation compared.
334. Of clearing the beds of rivers.
335. Docks.
336. Graving docks,
Their construction.
337. Driving piles.
338. Flood-gates.
339. Clear-

339. Clearing the silt,
By a head of water,
By machines,
The mud machine.

340. Harbours.
Natural,
And artificial.
Ramsgate harbour.

341. Piers.

342. Quays.

343. On the mooring of vessels.

Mooring chains.

344. Anchorage.

345. On the construction of vessels.

Launching of ships.

346. Experiments on the stability of floating
bodies.

The metacenter,

Flare-sided vessels.

Wall-sided.

Tumble home.

347. Ex-

347. Experiments on the resistance of water.
The proper form of ships.
The rake.
348. The form and use of the rudder.
349. The use of the keel,
Of false keels,
Of lee-boards.
350. Of caulking,
And paying the bottoms and sides of vessels.
351. The masts of ships,
Yards,
Sails,
And cordage.
352. Of square-rigged,
And sloop-rigged vessels.
353. Trimming the sails.
354. Tacking and wearing.
355. The interior structure,
And furniture of ships.

